

UNITED STATES OF AMERICA  
POSTAL REGULATORY COMMISSION  
WASHINGTON, DC 20268-0001

Before Commissioners:

Robert G. Taub, Chairman;  
Mark Acton, Vice Chairman;  
Tony Hammond; and  
Nanci E. Langley

Periodic Reporting  
(Proposal Four)

Docket No. RM2016-12

ORDER ON ANALYTICAL PRINCIPLES USED IN PERIODIC REPORTING  
(PROPOSAL FOUR)

(Issued June 22, 2017)

I. INTRODUCTION

On August 22, 2016, the Postal Service petitioned the Commission pursuant to 39 C.F.R. § 3050.11 to initiate a rulemaking.<sup>1</sup> The purpose of the rulemaking is to consider a proposal to change analytical principles relating to the Postal Service's periodic reports. The Postal Service proposes to change the methodology for the treatment of attributable purchased highway transportation costs within the Cost and Revenue Analysis (CRA). It proposes to implement this change by incorporating the variability of purchased highway transportation capacity with respect to volume into the calculation of attributable costs for purchased highway transportation. Petition, Proposal Four at 2.

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<sup>1</sup> Petition of the United States Postal Service for the Initiation of a Proceeding to Consider Proposed Changes in Analytical Principles (Proposal Four), August 22, 2016 (Petition).

The Commission approves Proposal Four with respect to the calculation of variabilities applicable to transportation accounts associated with regular routes only. Further development is necessary with respect to emergency and Christmas highway transportation routes before approval can be granted.

In reaching its decision, the Commission focuses on three issues. In Chapter V, the Commission analyzes the applicability of the Transportation Cost System (TRACS) database as the source of data for the proposed variability analysis. In Chapter VI, the Commission analyzes whether the proposed econometric model captures relevant aspects of the economic environment and operational decisions and whether the estimated variabilities are statistically reliable. In Chapter VII, the Commission analyzes whether using the product of two variabilities, each relying on data from a different database, is appropriate for the purpose of determining the overall variability of purchased highway transportation cost.

In Chapter VIII, the Commission provides the variabilities by transportation account category as approved in this Order. This chapter also estimates the impact of capacity-to-volume variabilities on Fiscal Year (FY) 2016 transportation costs as approved in this Order.

A separate discussion of a simulation model developed by the Brattle Group on behalf of United Parcel Service, Inc. (UPS) appears in the Appendix to this Order.

## II. PROCEDURAL HISTORY

The Postal Service filed its Petition on August 22, 2016. Petition. The Postal Service's Petition is supported by a report provided by Professor Michael D. Bradley, Department of Economics, the George Washington University.<sup>2</sup> In support of its proposal, the Postal Service also filed public and nonpublic library references.<sup>3</sup>

On August 24, 2016, the Commission established Docket No. RM2016-12 to consider the Petition, provide notice of the Petition in the *Federal Register*, establish deadlines to receive comments and reply comments, and assign an officer of the Commission to represent the interests of the general public.<sup>4</sup>

The Postal Service provided responses to four Chairman's Information Requests during the pendency of this proceeding.<sup>5</sup>

The Parcel Shippers Association (PSA), the Public Representative, and UPS filed comments.<sup>6</sup> UPS's comments are supported by a report provided by Dr. Kevin

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<sup>2</sup> Petition, Research on Estimating the Variability of Purchased Highway Transportation Capacity with Respect to Volume, by Professor Michael D. Bradley, Department of Economics, George Washington University, August 22, 2016 (Bradley Report).

<sup>3</sup> Library Reference USPS-RM2016-12/1, August 22, 2016; Library Reference USPS-RM2016-12/NP1, August 22, 2016.

<sup>4</sup> Order No. 3482, Notice of Proposed Rulemaking on Analytical Principles Used in Periodic Reporting (Proposal Four), August 24, 2016; see 81 FR 59592 (August 30, 2016).

<sup>5</sup> Responses of the United States Postal Service to Questions 1-9 of Chairman's Information Request No. 1, September 13, 2016 (Response to CHIR No. 1); Responses of the United States Postal Service to Questions 1-10 of Chairman's Information Request No. 2, September 30, 2016 (Response to CHIR No. 2); Responses of the United States Postal Service to Questions 1-5 of Chairman's Information Request No. 3, October 5, 2016 (Response to CHIR No. 3); Responses of the United States Postal Service to Questions 1-6 of Chairman's Information Request No. 4, October 11, 2016.

<sup>6</sup> Parcel Shippers Association Comments on the Rulemaking on Analytical Principles Used in Periodic Reporting (Proposal Four), October 17, 2016 (PSA Comments); Public Representative Comments, October 17, 2016 (PR Comments); United Parcel Service Comments on Postal Service Proposal Four Regarding Proposed Changes in Analytical Principles, October 17, 2016 (UPS Comments).

Neels and Dr. Nicholas Powers of the Brattle Group.<sup>7</sup> UPS also filed a supplement to its comments.<sup>8</sup>

Amazon Fulfillment Services, Inc. (AFSI), the Postal Service, the Public Representative, and UPS filed reply comments.<sup>9</sup> AFSI's reply comments are supported by a declaration from Dr. T. Scott Thompson of Bates White, LLC.<sup>10</sup> The Postal Service's reply comments are supported by a report provided by Professor Michael D. Bradley, Department of Economics, the George Washington University.<sup>11</sup> UPS's reply comments are supported by a report provided by Dr. Kevin Neels and Dr. Nicholas Powers of the Brattle Group.<sup>12</sup>

### III. BACKGROUND

The variability of purchased highway transportation cost with respect to volume is developed by taking the product of two variabilities: the variability of cost with respect to

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<sup>7</sup> UPS Comments, Report of Dr. Kevin Neels and Dr. Nicholas Powers to Accompany UPS Comments in Docket No. RM2016-12, October 17, 2016 (Brattle Report).

<sup>8</sup> United Parcel Service, Inc.'s Supplement to its Initial Comments with Informal Responses to Postal Service Questions, November 4, 2016 (UPS Supplemental Comments).

<sup>9</sup> Reply Comments of Amazon Fulfillment Services, Inc., November 14, 2016 (AFSI Reply Comments); Reply Comments of the United States Postal Service, November 14, 2016 (Postal Service Reply Comments); Public Representative Reply Comments, November 14, 2016 (PR Reply Comments); United Parcel Service Inc.'s Reply Comments to the Public Representative's Initial Comments Regarding Proposal Four, November 14, 2016 (UPS Reply Comments). The Public Representative also filed a redacted version of his reply comments. PR Rev & Redacted Reply Comments (Redacted in Black), November 15, 2016.

<sup>10</sup> Declaration of T. Scott Thompson on Behalf of Amazon Fulfillment Services, Inc., November 14, 2016 (Thompson Declaration).

<sup>11</sup> Postal Service Reply Comments, Report to Accompany the Postal Service's Reply Comments in Docket No. RM2016-12, by Professor Michael D. Bradley, Department of Economics, the George Washington University, November 14, 2016 (Bradley Reply Report).

<sup>12</sup> UPS Reply Comments, Reply Report of Dr. Neels and Dr. Nicholas Powers to Accompany UPS Reply Comments in Docket No. RM2016-12, November 14, 2016 (Brattle Reply Report).

capacity (cost-to-capacity variability) and the variability of capacity with respect to volume (capacity-to-volume variability).<sup>13</sup>

Cost-to-capacity variability is defined as “the elasticity of the cost of purchased transportation relative to a change in the cubic-foot-miles [(CFM)] of capacity purchased.” Docket No. R2000-1, Opinion at ¶ 3250. Its estimation “has been based on complex empirical analyses [that involved] advanced econometric techniques.” *Id.* at ¶ 3252. It has been gradually developed in a number of the dockets including Docket Nos. R87-1, R97-1, and R2000-1. *Id.* at ¶ 3255. Recently, in Docket No. RM2014-6, the Commission approved updated variabilities of purchased highway transportation cost with respect to capacity.<sup>14</sup>

Capacity-to-volume variability is defined as “the elasticity of the [CFM]...of capacity purchased relative to a change in the overall volume of mail using the transportation segment being analyzed.” Docket No. R2000-1, Opinion at ¶ 3250. Prior to the instant docket, this variability had not received extensive empirical analysis and is currently assumed to be 1.0 (or 100 percent), implying proportionality between capacity and volume. *Id.* at ¶ 3251. The Commission, however, did not view the assumption of proportionality as the final resolution of the matter. *Id.* In Order No. 1626, the Commission noted that “it would be beneficial for the Postal Service to investigate the validity of the current assumption that purchased highway transportation capacity varies in direct proportion to piece volume.”<sup>15</sup>

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<sup>13</sup> Petition, Proposal Four at 2; see also Docket No. R2000-1, Opinion and Recommended Decision, Volume 1, November 13, 2000, at ¶ 3250 (Docket No. R2000-1, Opinion); see Errata Notice, November 30, 2000.

<sup>14</sup> Docket No. RM2014-6, Order No. 2180, Order on Analytical Principles Used in Periodic Reporting (Proposals Three through Eight), September 10, 2014, at 12, 15; see Petition, Proposal Four at 1.

<sup>15</sup> Docket No. RM2011-3, Order Setting Near-Term Priorities and Requesting Related Reports, January 18, 2013, at 6-7 (Order No. 1626).

In response to Order No. 1626, the Postal Service asserted that this assumption had “never been supported nor contradicted by empirical evidence.”<sup>16</sup> The Postal Service investigated the use of Transportation Information Management Evaluation System (TIMES) and Surface Visibility (SV) data to estimate the variability of capacity with respect to volume “but found those data were not accurate enough to serve that purpose.”<sup>17</sup> The Postal Service noted that “the econometric results [still] produced preliminary evidence suggesting that capacity [wa]s not perfectly proportional to volume.” Response to Order No. 1626 at 24.

Considering “the potential importance of [the] issue,” the Postal Service stated it was planning to investigate the use of quarterly TRACS data by day-of-week (DOW), an “approach first suggested by the Commission” in Docket No. N2010-1.<sup>18</sup>

#### IV. PROPOSAL FOUR: METHODOLOGY AND IMPACT

The Postal Service proposes to update capacity-to-volume variabilities of purchased highway transportation by applying a modified approach first suggested by the Commission in Docket No. N2010-1 and utilizing TRACS data for the FY 2010 through FY 2015 time period.<sup>19</sup> The Postal Service maintains that “the empirical results strongly rejected the assumption of proportionality between capacity and volume.” Petition, Proposal Four at 3. The Postal Service estimated capacity-to-volume variabilities by transportation type “from the translog model using [DOW] data from FY[]2011 through FY[]2015, corrected for autocorrelation.” Bradley Report at 33-34;

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<sup>16</sup> Docket No. RM2011-3, Postal Service Report Regarding Cost Studies: Response to PRC Order No. 1626, April 18, 2013, at 23 (Response to Order No. 1626).

<sup>17</sup> Docket No. RM2011-3, Summary of Recent Research Activity and Inquiry Regarding Timetable for Completing Analyses and Applying Results, September 5, 2013, at 2 (Order No. 1829). See also Response to Order No. 1626 at 24; Bradley Report at 4-5; Response to CHIR No. 1, question 1.

<sup>18</sup> *Id.* at 24-25; see also Order No. 1829 at 2; Docket No. N2010-1, Advisory Opinion on Elimination of Saturday Delivery, March 24, 2011, at 98 (Docket No. N2010-1, Advisory Opinion); Docket No. N2010-1, Library Reference PRC-N2010-1-LR-5, March 24, 2011.

<sup>19</sup> Petition, Proposal Four at 2-3; Bradley Report at 6-33; see PRC-N2010-1-LR-5, file “PRC Transportation Appendix.docx.”

see *a/so* Petition, Proposal Four at 3-4. These variabilities were incorporated into the Postal Service's transportation cost model. Petition, Proposal Four at 3.

Rejection of the assumption of proportionality between capacity and volume leads to a decreased overall variability of purchased highway transportation (estimated by each transportation type) and, consequently, to a reduction in the attributable purchased highway transportation costs. *Id.* at 5; Bradley Report at 34-35. Since the estimated capacity-to-volume variabilities vary by transportation type, the impact of newly estimated variabilities on transportation costs "will depend upon the mix of purchased highway transportation cost used by the product." Petition, Proposal Four at 5; Bradley Report at 35. As estimated by the Postal Service using FY 2015 CRA data, the updated capacity-to-volume variabilities would result in a total decrease in transportation attributable costs by over \$0.5 billion.<sup>20</sup>

## V. UTILIZATION OF TRACS AS A DATA SOURCE

### A. Reliability of TRACS Data

Commenters question the applicability of the TRACS database as a source for variability analysis. Their comments address concerns regarding a low sampling rate, variation of TRACS data by day of the week, differences in TRACS data versus actual Revenue, Pieces, and Weight (RPW)/CRA data, and possible measurement error of TRACS capacity utilization.

For the reasons discussed below, the Commission concludes that the TRACS database is reliable and generally suitable for the variability analysis applicable to highway transportation accounts associated with regular routes.

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<sup>20</sup> Petition, Proposal Four at 6; Bradley Report at 36; see *a/so* USPS-RM2016-12/1, file "USPS.RM2016.12.1.Prop.4\_Public.zip," folder "Cost.Impacts.Capacity.Volume.Variabilities."

## 1. Commenters' Arguments

*Low sampling rate.* UPS argues that TRACS samples are too small and, therefore, TRACS does not provide a reliable data source for calculating capacity-to-volume variabilities. Brattle Report at 10; see *also* UPS Comments at 8-9. UPS asserts that the low sampling rates applied in TRACS data collection produce “extremely noisy” capacity and volume estimates. Brattle Report at 10.

The Postal Service disputes these concerns. Bradley Reply Report at 3-4. It argues that UPS conflates the sampling variation in TRACS (that does not cause bias) with measurement error. *Id.* at 3. The Postal Service also contends that if there were too much sampling variation in the TRACS data, the regression model would fail to estimate a statistically significant relationship between capacity and volume. *Id.*

AFSI contends that UPS fails to quantify or provide reliable evidence of any sampling error in the TRACS data. Thompson Declaration at 31. Using a specific example, AFSI further notes that data based on sampling rates that are lower than the ones in TRACS are often used in reliable econometric analysis. *Id.*

The Public Representative states he “does not fully agree” with the contention that TRACS sample sizes are too small and variable to be relied upon for calculating variabilities. PR Reply Comments at 2.

*Variation of TRACS data by day of the week.* UPS points to significant variation in the number of TRACS tests on a given day of the week during different periods of time. Brattle Report at 22-23. Specifically, UPS notes examples of year-over-year changes in TRACS measures of mail volume that are “strikingly different” from comparable year-over-year changes in measured capacity. *Id.* at 22. The Public Representative concludes that the “prevalence of this mismatch provides empirical evidence that...aggregating [data by day of the week] produces measurement error” in TRACS data. PR Reply Comments at 6.

The Postal Service disputes UPS’s assertions of disparity between year-over-year changes in TRACS measures of mail volume and comparable year-over-year changes in measured capacity. Bradley Reply Report at 13-26. The Postal Service



argues that UPS's work is "just a search for a few unusual observations, and is misleading as an evaluation of the overall pattern of volume and capacity movements." *Id.* at 13-14. To support this statement, the Postal Service estimates correlation between year-over-year changes in capacity and volume by transportation account category and concludes that this relationship is "remarkably stable."<sup>21</sup>

*TRACS volumes versus RPW volumes.* UPS compares TRACS volume data with volumes from the FY 2015 RPW report. Brattle Report at 11. It plots TRACS mail volume data against a weighted volume measure it developed using RPW data (weighted volumes) and also performs a regression analysis of TRACS volume estimates on these weighted volumes.<sup>22</sup> UPS concludes that only a small share (which range from 0.1 to 15 percent) of the variation in TRACS mail volumes can be explained by variation in the RPW weighted volumes. Brattle Report at 14. In addition, UPS asserts that the weighted volume measure displays "clear seasonal variation," while the TRACS-based volume measure "appears to fluctuate randomly, with little evidence of any regular seasonality." *Id.* at 13.

The Public Representative agrees that the RPW weighted volume measure has more appropriate annual and seasonal variations than the TRACS mail volume measure. PR Reply Comments at 4.

AFSI and the Postal Service contend that the concerns regarding the noted differences are not valid. See Thompson Declaration at 32-33; Bradley Reply Report at 6-8; Postal Service Reply Comments at 2. The Postal Service states that UPS's comparisons "contain both conceptual and computational errors." Bradley Reply Report at 4; see *also* Postal Service Reply Comments at 2.

The Postal Service notes that TRACS and RPW "measure very different things." Bradley Reply Report at 5. It states that quarterly variations in multiple factors (such as

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<sup>21</sup> *Id.* at 14. The estimated correlation coefficients are in the range between 79.6 percent and 88.0 percent depending on the transportation account category. *Id.*; see *also* Library Reference USPS-RM2016-12/3, November 14, 2016, folder "Table3."

<sup>22</sup> *Id.* at 14; see *also* Library Reference UPS-LR-RM2016-12/NP1, October 17, 2016, folder "2 - Weighted Volume Analysis."

the cubic volume distribution of mail or the proportion of mail transported on the various parts of the highway transportation network) cause TRACS and RPW measures to deviate from one another. *Id.*

AFSI and the Postal Service argue that the comparison of TRACS volumes with the RPW “weighted volumes” measure is unreliable. Thompson Declaration at 33; Bradley Report at 5-10. They examine the formula that UPS uses to compute the “weighted volumes” measure and conclude the formula’s output represents costs, which are equal to the FY 2015 attributable costs for highway transportation reported in RPW.<sup>23</sup> AFSI notes that “[t]he weighted volume measure could offer a reliable index for volume measured in [CFM] [but] only under special circumstances,” which he believes are unlikely to be met.<sup>24</sup>

The Postal Service also notes that in its comparison, UPS does not account “for the restructuring of the Postal Service’s package services products.” Bradley Reply Report at 8. Using a specific example of Parcel Post that shifted to Standard Post in FY 2013, the Postal Service illustrates that UPS applied zero weight for Parcel Post volumes in the calculation of “weighted volumes” for the years FY 2010 through FY 2013 and therefore substantially understated these “weighted volumes” in these years. *Id.* at 8-10.

*TRACS cost data versus actual CRA costs.* UPS notes that in FY 2013, the accuracy of the “COST” variable in TRACS started to improve. Brattle Report at 21. Using TRACS data from FY 2013 through FY 2015, UPS constructs cost “population estimates” and compares them with “quarterly cost totals on regular routes” reported in the CRA report.<sup>25</sup> Based on the graphical comparison (by transportation account)

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<sup>23</sup> Thompson Declaration at 32; Bradley Reply Report at 6-8.

<sup>24</sup> Thompson Declaration at 33. The circumstances AFSI cites are: “(1) the proportion of pieces traveling via the given mode of highway transportation is constant over time and (2) there is no variation over time in the per piece average CFM for the class of mail when it travels over the given mode of highway transportation.” *Id.*

<sup>25</sup> Brattle Report at 20-21; see also Library Reference UPS-LR-RM2016-12/1, October 17, 2016, file “4 - Cost Comparison.zip,” folder “4 - Cost Comparison.”

between the constructed TRACS-based cost estimates and the CRA costs, UPS concludes that TRACS-based cost estimates “persistently overestimate actual costs on regular routes” and display a “wide variation over time...resulting from low sampling rates.” Brattle Report at 20-21.

The Postal Service disagrees with UPS’s conclusions concerning the low quality of TRACS data drawn from the provided comparison. Bradley Reply Report at 11-17. The Postal Service criticizes the approach UPS uses to construct its TRACS-based cost “population estimates” stating that they are “mistakenly asserted to be a population estimate of a contract type’s quarterly accrued regular cost.” *Id.* at 11. The Postal Service further asserts that the accuracy of the TRACS “COST” variable that UPS relied upon in its cost estimates “is not verified” and “is not used” in the calculation of distribution factors and therefore “should not be used for estimating costs.” *Id.*

*Measurement error of TRACS capacity utilization.* UPS asserts that “the capacity utilization figures contained in TRACS are ‘guesstimates’ rather than the results of careful measurement.” Brattle Report at 24. UPS supports this assertion by examining TRACS truck capacity utilization measurements, which, as it claims, show that 88 percent of the observations fall on round numbers ending in “0” or “5,” and there are twice as many observations ending in “0” as there are ending in “5.”<sup>26</sup> UPS therefore contends that there is evidence of a rounding process in recording TRACS measurements, which represents a “clear source of measurement error” affecting the variability analysis and conclusions. *Id.* at 24, 26.

The Public Representative suggests that vehicle capacity measurements “are not likely to be done in exactly the same manner.” PR Comments at 21; see *also* PR Reply Comments at 6. Referring to the Brattle Report, the Public Representative estimates that 81 percent of truck capacity measurements are done using “the 5 percent increment rule of thumb.” PR Reply Comments at 6.

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<sup>26</sup> Brattle Report at 25-26; see *also* UPS-LR-RM2016-12/1, file “6 - Usage Statistics.zip.”

## 2. Commission Analysis

The TRACS database includes two parts: Surface (highway) and Air sub-systems. It is used by the Postal Service “to estimate transportation costs and attribute those costs to different mail categories.”<sup>27</sup> As an ongoing statistical sampling system, TRACS contains different types of data that, as the Commission previously noted, provide useful information “for estimating the response of transportation activity to mail volume levels.” Docket No. N2010-1, Opinion at 98 n.58. TRACS Surface utilizes a multi-stage sampling design that follows well accepted sampling techniques, and has been in place for a significant time period.<sup>28</sup> Therefore, the Commission dismisses UPS’s concern that sampling issues make TRACS unreliable as a data source for variability analysis.

In an attempt to illustrate negative implications of “very low sampling rates employed in collecting the TRACS data,” UPS uses a comparison between the RPW data and TRACS volume data, and concludes that TRACS-based “system-wide” volume estimates are very different from RPW volumes. Brattle Report at 10-18. UPS develops its total “weighted volume” measure using data from both RPW and CRA as a two-step process. First, for each class of mail, it takes a piece count from a quarterly RPW report, multiplies it by what it calls “usage weight” (average cost per piece for this class of mail from a CRA report for the same quarter), and makes a summation by all mail classes. *Id.* at 11-12. Second, to obtain the “final RPW-based volume measure” for this quarter, the intermediate measure is “adjusted”—multiplied by the ratio between

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<sup>27</sup> United States Postal Service Handbook F-65, *Transportation Cost Systems*, October 2012, at 4 (Handbook F-65). See Docket No. ACR2016, USPS-FY16-46, March 1, 2017, file “FY.16.46.ChIR.20.Public.Files.zip,” folder “ChIR 20 Q 11.”

<sup>28</sup> See Docket No. R90-1, Opinion and Recommended Decision, Volume 1 of 2, January 4, 1991, at ¶¶ 3638-3659. See, e.g., Docket No. ACR2016, Library Reference USPS-FY16-36, December 29, 2016, at 1, 10-20 (FY 2016 TRACS Documentation).

costs incurred on regular routes (which are sampled in TRACS) and all routes (including exceptional, emergency, and Christmas routes).<sup>29</sup>

The Commission does not find the measure constructed by UPS to be suitable for comparison with the TRACS-based volume totals. Contrary to UPS's claim that its "usage weight" reflects "usage intensity with respect to purchase highway transportation," it actually reflects the proportion of highway transportation costs allocated to each product.<sup>30</sup> Therefore, the formula that UPS relies on to generate the "weighted volume" using the RPW and CRA data produces estimates of costs, which should not be compared to TRACS *volume* estimates. Both AFSI and the Postal Service note this discrepancy. Thompson Declaration at 32-33; Bradley Reply Report at 6-8. Also, by applying the FY 2015 average cost per piece as a weighting index to piece counts in a particular quarter and year, UPS ignores the transfer of products from market dominant to competitive mail categories that occurred before FY 2015.

The Postal Service uses TRACS quarterly CFM estimates to develop distribution keys for purchased highway transportation costs. FY 2016 TRACS Documentation at 1, 10-22. However, as noted by Bradley, the total mail volumes developed using TRACS data do not need to be equal to the RPW-based national-level highway volume estimates. See Bradley Reply Report at 6.

Similarly, TRACS cost estimates do not have to be the same as costs reported in the CRA. The Brattle Group inadequately compares cost data from the CRA report with the cost estimates the Brattle Group develops using values of the "COST" variable reported in TRACS. See Brattle Report at 11. The Postal Service, however, did not attempt to use this variable in its estimation of cost-to-capacity variabilities and

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<sup>29</sup> *Id.* at 12-13. The Brattle Group provides such an adjustment considering that TRACS includes data from samples taken on regular routes only. See *id.* at 12 (citing Response to CHIR No. 3, question 4).

<sup>30</sup> See Brattle Report at 12. The weights used in the Brattle "weighted volume" calculation are from UPS-LR-RM2016-12/NP1, folder "Data Source," Excel file "CS14-NP-FY15.Proposed.Variabilities.xlsx," worksheet "2015 Costs." They are calculated using Cost Segment 14 Transportation CRA data from Docket No. ACR2015, Library Reference USPS-FY15-NP14, December 29, 2015, file "CS14-NP-F15.xlsx," worksheet "WS14.4."

specifically warned that the TRACS cost measure is a “cost for one leg,” which reflects “the overall annual contract cost” and “may be caused by other routes or capacities besides the one being tested in TRACS.” Response to CHIR No. 1, question 8.

To provide a reliable input for estimating capacity-to-volume variabilities, the TRACS database must adequately capture the relationship between capacity and volume. This ability is inherent in the very nature of TRACS Surface data, which contains “weight and volume (count) by mail category” recorded at testing facilities (including NDCs and SCFs) using samples of mail unloaded from trucks of known capacity. See Handbook F-65 at 4-5. As a sampling database, TRACS is subject to data variation, including possible variation in quarterly changes in capacity relative to quarterly changes in volume for a given day of the week, which was observed by UPS. Brattle Report at 22-23. The Commission agrees with the Postal Service that the presence of unusual observations that cause such variation do not make TRACS unsuitable for variability analysis unless it alters the statistically reliable relationship between capacity and volume estimated by the regression model. Bradley Report at 15-16. As further discussed in Chapter VI, the Commission finds that the estimated variabilities are statistically reliable.

The Commission is not persuaded by UPS’s or the Public Representative’s concerns regarding measurement error of TRACS capacity utilization. The concerns appear to reflect a misunderstanding of how vehicle capacity utilization is recorded in TRACS. Handbook F-65 provides instructions to data collectors regarding the process of recording vehicle utilization information. See Handbook F-65 at 9-10. A data collector must consider three components of vehicle utilization: percentage of empty space in the vehicle, percentage of unloaded mail, and percentage of mail remaining in the vehicle, where the sum of measurements for these three components equals “100 percent of a vehicle’s floor space.” *Id.* at 9. Recording measurements for each component is subject to more detailed instructions that involve recommendations to ensure the accuracy of measurements (e.g., counting unloaded containers and pallets, directly entering a vehicle and using markings inside the wall and tape measure to

better estimate the percentage of mail remaining on the vehicle). *Id.* at 9-10. The rounding process that UPS refers to as another source of measurement error does not cause any significant problem since data collectors involved in recording vehicle capacity utilization would perform rounding up and down equally often. See Brattle Report at 26. The rounding process does not alter the relationship between vehicle capacity and mail volume estimated by econometric equations using a subset of TRACS data.

The Commission finds that, with the exception of emergency and Christmas routes, as discussed below, the TRACS database provides a reliable source suitable for estimating capacity-to-volume variabilities of purchased highway transportation. The Commission is not persuaded by the concerns expressed above by UPS and the Public Representative.

#### B. Treatment of Christmas and Emergency Routes

UPS argues that TRACS excludes Christmas and emergency routes from its sampling frame and, therefore, estimated variability cannot be applied to these routes. UPS Comments at 9-11; Brattle Report at 18-20.

The Commission finds that UPS's arguments are reasonable. For Christmas and emergency routes, the Commission concludes that the TRACS database is not suitable for the proposed variability analysis.

##### 1. Commenters' Arguments

UPS observes that the TRACS database does not include data on Christmas or emergency routes. Brattle Report at 19; see *also* UPS Comments at 9. At the same time, the Postal Service's CRA report does include purchased highway transportation costs associated with Christmas and emergency routes. Brattle Report at 18.

UPS contends that since Christmas and emergency routes are not sampled in TRACS, distribution keys based on TRACS data should not be applied to Christmas and emergency routes. *Id.* at 20; see *also* UPS Comments at 9-11. Taking FY 2015,

Quarter 1 as an example, UPS states that 23 percent of the Inter-SCF costs were in one of the cost pools “that appear to refer to Christmas routes.” Brattle Report at 18. UPS argues that considering the Postal Service experiences a “spike in package volume” during the Christmas season, all the costs accrued by Christmas routes are most likely caused by increases in mail volume. *Id.* at 19.

UPS further notes that the makeup of mail volumes on Christmas routes is likely to be different from regular routes and, in particular, “[t]he cubic footage of mail transported on holiday routes...is likely to be more heavily comprised of parcel products than that of mail transported on regular routes.” UPS Comments at 9-10. UPS suggests that the Commission require the Postal Service to look into the makeup of mail volume on Christmas routes. *Id.* at 10-11.

The Postal Service agrees that seasonal contracts “are likely to be more directly related to changes in volume...than are regular contracts,” and “could perhaps be treated as more or even fully attributable.” Postal Service Reply Comments at 6. The Postal Service, however, notes that spikes in volume transported on Christmas routes “concurrently show[] up on regular routes, and thus are appropriately captured by the quarterly distribution factors from TRACS.” *Id.* at 6-7. The Postal Service also observes that Christmas routes are outside the scope of Proposal Four and contends that suggestions on variabilities related to Christmas contracts could have been “advanced entirely independent of Proposal Four.” *Id.* at 5, 7.

## 2. Commission Analysis

UPS and the Public Representative note that TRACS-based volume estimates (unlike RPW-based volume measures) do not display any recognizable seasonality trends. Brattle Report at 13; PR Reply Comments at 4. The fact that TRACS includes data samples recorded exclusively on regular routes might provide a possible explanation for this observation.

An examination of CRA Cost Segment 14 (the cost segment that covers costs of transportation contracts) shows that these highway transportation costs are divided into



cost pools for regular, exceptional, emergency, and Christmas service routes.<sup>31</sup> The regular service routes sampled in TRACS make up the majority of highway transportation costs in the CRA.

For the variability analysis in Proposal Four, it is important to consider the differences between highway transportation route types in Cost Segment 14 of the CRA. The Postal Service admits that exceptional routes are “different from regularly scheduled transportation,” and their “costs are accrued in [the] separate cost pools by account category.” Response to CHIR No. 3, question 4. The Postal Service states that “under the approved Commission methodology, [exceptional routes] are assumed to be 100 percent variable with volume.” *Id.* Proposal Four does not consider any change in treatment of exceptional routes.

The Postal Service states that emergency contracts are “short-lived” contracts. Considering that very little transportation is provided under emergency contracts, “it is not feasible for TRACS to include such contracts in its sampling frame.” *Id.* An endnote in Excel file “CS14-P-FY15.Proposed.Variabilities.xlsx” indicates that “Christmas highway accounts are issued under emergency contract rules.” *See id.* tab “Endnotes.” Thus, neither Christmas nor emergency contracts are accounted for in the TRACS database.

By their very nature, emergency and Christmas contracts are purchased under different circumstances than regular contracts. The Postal Service arranges emergency contracts (including Christmas contracts) as “short-run purchases of highway transportation.” Response to CHIR No. 3, question 4. This appears to be similar to the exceptional contracts (that are arranged on an “extremely short[-]term” basis). *Id.* The Postal Service asserts that “spikes in volume are being transported on Christmas routes are likewise concurrently showing up on regular routes, and thus are appropriately captured by the quarterly distribution factors from TRACS.” Postal Service Reply

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<sup>31</sup> See USPS-RM2016-12/1, file “USPS.RM2016.12.1.Prop.4\_Public.zip,” folder “Cost.Impacts.Capacity.Volume.Variabilities,” file “CS14-P-FY15.Proposed.Variabilities.xlsx,” tab WS14.3, lines 96-140.

Comments 6-7. This assertion, however, is not supported by any data analysis. At the same time, distribution of highway transportation costs incurred on Christmas routes is not consistent by quarter, with a significantly higher concentration of such costs in Quarter 1. See Brattle Report at 18; UPS Comments at 9-10. Using the Intra-SCF transportation account category as an example, the FY 2016 quarterly share of adjusted accrued costs for regular routes is relatively stable for all four quarters (it ranges from 24.3 to 25.5 percent). See Table V-1. However, costs for emergency routes vary significantly by quarter, and costs for Christmas routes are mostly concentrated in Quarter 1. This implies that the variabilities of emergency and Christmas routes may not be “appropriately captured by the quarterly distribution factors” derived from regular routes. Postal Service Reply Comments at 6-7.

**Table V-1**  
**FY 2016 Quarterly Share of Adjusted Accrued Costs by Contract Type**  
**(Intra-SCF Account Category)**

Account Category	Contract Type	Quarterly Share of Adjusted Accrued Costs <sup>32</sup> (%)			
		Q1	Q2	Q3	Q4
Intra-SCF	Regular	25.4	24.3	24.9	25.5
	Exceptional	23.8	26.7	22.8	26.7
	Emergency	34.3	39.0	14.0	12.6
	Christmas	68.2	30.4	1.5	0.0

Source: CRA FY 2016, C/S14, tab “WS14.3;” see Library Reference PRC-LR-RM2016-12/1, tab “Table V-1\_Calc.”

The Commission finds that the Postal Service does not provide sufficient evidence to conclude that capacity-to-volume variabilities estimated using TRACS data that is sampled on regular routes would be applicable to emergency and Christmas routes. The Postal Service “acknowledges some validity to the notion that seasonal

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<sup>32</sup> The adjusted accrued costs do not include penalties and fines.

contracts...are likely to be more directly related to changes in volume...than are regular contracts.” Postal Service Reply Comments at 6. Considering that extra highway transportation capacity purchased for emergency and Christmas routes is intended to accommodate increases in mail volume, the Commission concludes that it is likely that the capacity-to-volume variabilities for emergency and Christmas routes are higher than for regular routes. Therefore, the Commission does not support the application of TRACS-based capacity-to-volume variabilities to emergency and Christmas route highway transportation accounts. The Commission concludes that for the accounts associated with these types of routes, the Postal Service shall continue to apply the current assumption regarding proportionality between capacity and volume.

## VI. RELIABILITY OF THE ECONOMETRIC ANALYSIS

### A. Modeling Approach and its Reflection of Operational Decisions

Commenters question whether the econometric model captures relevant aspects of the economic environment or operational decisions. They also question whether the model captures key aspects of the contracting process and accurately represents operational decision making. Their comments address concerns regarding the unit of observation and unit of analysis, variability of less than “1,” TRACS tests with zero mail volume, and the DOW variable.

For the reasons discussed below, the Commission finds that the modeling approach underlying Proposal Four is reasonable.

#### 1. Commenters’ Arguments

*Unit of observation and unit of analysis.* UPS asserts that for the analysis of the relationship between volume and capacity, the model incorrectly uses a stop on a route (instead of the route) as a unit of observation. Brattle Report at 27; see *also* UPS Comments at 7, 12. UPS maintains that such an approach contradicts operational realities. *Id.*

The Postal Service states that the unit of observation in econometric analysis might not “be at the same level as the level at which data are collected.” Bradley Reply Report at 19. It argues that although the unit of observation in TRACS is a stop, the unit of econometric analysis is “a unit of time,” and the econometric equations are estimated using time-series data (and not cross-sectional data, which would require a route as a unit of analysis). *Id.* at 18-19.

UPS further criticizes the modeling approach for not considering the “volume of mail at the peak load point of the route” to determine “the amount of capacity” provided at a stop along the route. Brattle Report at 28; *see also* UPS Comments at 7. It also argues that by including TRACS tests with low capacity utilization in the econometric model, the Postal Service biases the variability estimates downward. Brattle Report at 38-39. To support this claim, UPS calculates capacity-to-volume variabilities for subsets of TRACS tests with different levels of capacity utilization.<sup>33</sup> UPS concludes that when the data set includes TRACS tests where trucks are at least 50 percent full, the estimated capacity-to-volume variabilities “are very close to 1.” Brattle Report at 39.

The Public Representative supports UPS by stating that capacity decisions should be based on measurements that display at least 50 percent of vehicle capacity utilization under today’s conditions of relatively stable cubic mail volume.<sup>34</sup>

The Postal Service and AFSI disagree with UPS that peak volume is a correct unit of analysis. The Postal Service notes that peak volume is not the sole determinant of purchased highway transportation capacity. Furthermore, the Postal Service states that it has “more flexibility in setting its capacity than the Brattle Group Report suggests.” Bradley Reply Report at 19-20. In addition, the Postal Service argues that the methodology of a test implemented by UPS, where it eliminated TRACS observations with capacity utilization below 50 percent, “imposes a guaranteed result of a high variability.” *Id.* at 31.

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<sup>33</sup> *Id.* at 39; *see also* UPS-LR-RM2016-12/1, file “8 - TRACS variations.zip.”

<sup>34</sup> PR Reply Comments at 5. The Public Representative evaluates cubic mail volume trends from FY 2011 through FY 2015 to reach this conclusion. *Id.*

AFSI outlines alternative considerations for accommodating peak volumes and managing demands. Thompson Declaration at 10, 13-14.

*Variability of less than “1.”* UPS argues that variabilities of less than “1” (or less than 100 percent) imply that “in the face of continued growth, the network will eventually reach a point where it is operating at 100 percent of capacity, and can no longer accommodate further growth in mail volume” and that “in the face of declines in volume the Postal Service will allow capacity to fall without limit.” Brattle Report at 31, 32.

Responding to UPS, the Postal Service asserts that capacity-to-volume variability less than “1” does not mean the Postal Service will eventually reach full capacity, because the currently estimated variabilities do not need to remain unchanged as volume and capacity change. Bradley Reply Report at 22. AFSI similarly states that the “volume variability of capacity does not remain constant as volume changes, even if variability is approximately constant over small changes in volume.” Thompson Declaration at 9-10.

UPS also argues that the low sampling rates in TRACS (which are discussed in section V.A.1) cause a “downward bias” in variability estimates. Brattle Report at 47. To better support this claim, UPS simulates a transportation network and a dataset, and then uses a gravity model to generate daily mail volumes to be transported on the routes within a network.<sup>35</sup> UPS then constructs “a set of Bradley-style aggregate capacity and volume estimates” and estimates capacity-to-volume variabilities for samples with different sampling rates. Brattle Report at 40, 42-47. UPS maintains that the results of its simulation exercise indicate that “the variability estimate[s] decline[] noticeably” as the sampling rate decreases. *Id.* at 44. UPS notes that the simulated network structure “mirrors that of the Postal Service” but acknowledges that the model it created “is not similar enough to the actual Postal Service transportation network to quantify the extent of downward bias.” *Id.* at 40, 47. UPS concludes that a “downward

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<sup>35</sup> Brattle Report at 40-42; see also UPS-LR-RM2016-12/1, file “2 - README - Creation of Synthetic Dataset.zip.” For more details about UPS’s simulation model, including its description and analysis, see Appendix.

bias” of the variability estimates is caused by “low sampling rates in the TRACS data,” and, as a result, Proposal Four “does not reliably establish” that capacity-to-volume variabilities are “anything less than proportional.” *Id.* at 47.

AFSI and the Postal Service criticize the UPS simulation model for failing to realistically reflect the Postal Service’s network and operations. Bradley Report at 31-33; Thompson Declaration at 11. They also argue that the conclusions drawn from the simulation exercise are not applicable to Proposal Four. *Id.* The Postal Service maintains that the econometric equations developed in Proposal Four “do not produce the extremely low variabilities generated by the synthetic data in the UPS simulation exercise, and the variabilities estimated in Proposal Four “exhibit both high t-statistics and high  $R^2$  statistics.” Bradley Reply Report at 32-33.

In contrast, PSA supports variability of less than “1” “from an operational standpoint.” PSA Comments at 2. PSA notes that operating windows of destination facilities and service commitments may force the Postal Service to transport mail even when trucks are not completely full, which leads to a “less-than-proportional response of transportation capacity to changes in volume.” *Id.*

*TRACS tests with zero mail volume.* The Public Representative disagrees with the exclusion of observations (TRACS tests) with zero mail volume from econometric analysis. PR Comments at 10-12. The Public Representative asserts that per his estimation, such approaches lead to the exclusion of 18 percent of observations and therefore “diminish[] the accuracy of the model.” *Id.* at 10. The Public Representative suggests that the excluded observations could be due to instances in the course of normal postal operations (e.g., when a truck is already fully unloaded or a truck goes unused/underused to fulfill a requirement of the Universal Service Obligation (USO)).<sup>36</sup> *Id.* at 10-11. Finally, the Public Representative states that an accurate statistical analysis requires that all observations in the data set are retained. *Id.* at 12.

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<sup>36</sup> The Public Representative examines the excluded observations and concludes that each zero-volume observation corresponds to a positive measurement of vehicle capacity. PR Comments at 10; see also Library Reference PR-RM2016-12/1, October 17, 2016.

The Postal Service acknowledges that the Public Representative “provides a list of reasonable circumstances that could lead to valid zero[-]volume tests.” Bradley Reply Report at 34. However, it notes that it initially calculated capacity-to-volume variabilities both with and without zero-volume observations, and the inclusion of observations with zero volume in the econometric model only lowered the estimated variabilities. *Id.*; see also Bradley Report at 18-19.

UPS discusses zero mail volume observations as another illustration of problems “inherent in the TRACS dataset” but does not suggest that their inclusion would improve the econometric model. UPS Comments at 7-8; see also Brattle Report at 38-40. UPS argues that by “eliminating zero[-]volume samples the [Postal Service] seems to acknowledge the limitations inherent in the TRACS dataset.” UPS Comments at 7-8. UPS notes that zero-volume TRACS observations do not determine the capacity of the routes they belong to. Brattle Report at 38. UPS argues that by excluding zero-volume observations, the model significantly increases the estimated variabilities. *Id.*

*Day-of-week variable.* UPS argues that inclusion of a DOW variable in the econometric model implies that capacity can be adjusted on a day-to-day basis, which does not reflect the Postal Service’s operational realities. Brattle Report at 29-30; UPS Comments at 14. The Public Representative “agrees with UPS that the capacity of mail transported on a route on one day will influence the capacity of mail transported on a subsequent day,” and therefore the model fails to account for independence among days of the week. PR Reply Comments at 6-7.

UPS also argues that by treating days of the week as separate observations, the model “bias[es] downward estimates of the elasticity of capacity with respect to volume.” Brattle Report at 31.

To illustrate that UPS’s assertion is incorrect, the Postal Service compares the variabilities resulting from the original quarterly DOW aggregation with new ones derived from the equations using observations aggregated by quarter.<sup>37</sup> The Postal

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<sup>37</sup> Bradley Reply Report at 21-22; see also USPS-RM2016-12/3.

Service concludes that, in contrast to UPS's statement, "quarterly variabilities are in the same range as the day of [the] week variabilities." Bradley Reply Report at 21-22.

The Postal Service argues that organizing TRACS quarterly data by the day of the week does not assume day-to-day adjustment of capacity with respect to volume. Bradley Reply Report at 20-21. The Postal Service explains that the approach underlying Proposal Four "includes measures of quarterly, not daily, variations in volume and capacity." *Id.* at 21.

AFSI points out that the Postal Service only assumed that "capacity can vary by day of the week." Thompson Declaration at 17. AFSI provides examples of variation in number of trips and their frequency between weekdays and weekends (holidays), and concludes that the Postal Service has "the ability and incentive" to adjust highway capacity on a day of the week basis." *Id.* at 18-19.

## 2. Commission Analysis

The Commission previously questioned the assumption that purchased highway transportation capacity varied in direct proportion to mail volume. See Docket No. R2000-1, Opinion at ¶ 3251; Order No. 1626 at 6-7. Prior to Proposal Four, the Postal Service attempted to estimate capacity-to-volume variabilities using TIMES/SV data.<sup>38</sup> Results of this investigation (including a substantial amount of data quality issues) allowed the Postal Service to conclude that the TIMES/SV data "were not sufficiently reliable for supporting econometric analysis."<sup>39</sup>

In the instant proposal, the Postal Service used TRACS data that, as the Commission previously stated, provide reliable information for estimating capacity-to-

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<sup>38</sup> See Bradley Report at 4-5; Response to CHIR No. 1, question 1; Response to Order No. 1626 at 23-24.

<sup>39</sup> Bradley Report at 5; see *also* Order No. 1829 at 2; Response to Order No. 1626 at 24. For the tested regression models that relied upon TIMES/SV data, including the related regression output and datasets, see Library Reference USPS-RM2016-12/2, September 13, 2016. The library reference includes two SAS datasets (for Inter-BMC and Inter-P&DC accounts, respectively), a brief description of the models, and regression output.



volume variabilities for regular routes. The econometric model underlying Proposal Four follows the “exploratory analysis” the Commission performed in Docket No. N2010-1 but contains certain modifications.<sup>40</sup> Thus, the Postal Service expands TRACS data (from a one-year period of FY 2010 to a six-year period from FY 2010 through FY 2015) and refines the econometric equation (changes its functional form and adds variables). Bradley Report at 13-18. In a process of model calibration, the Postal Service tested alternative time aggregation for observations (by either day of the week in each quarter or week in a year), as well as the effect of excluding TRACS tests with zero mail volumes from the analysis. See *id.* at 13-22, 29-33.

By testing different modeling assumptions, the Postal Service develops regression equations that produce statistically reliable variability estimates. All capacity-to-volume variabilities derived from such equations appeared to be “well below [100] percent.” *Id.* at 17. The Commission finds that the results of the Postal Service’s analysis provide sufficient empirical evidence to properly conclude that change in vehicle capacity is less than proportional to change in volume of transported mail.

In its econometric analysis, the Postal Service not only rejects the assumption of proportionality between purchased highway capacity and transported mail volume, but also produces multiple alternative sets of statistically reliable regression equations. Considering that under current methodology, all purchased highway capacity-to-volume variabilities are considered “1,” a conservative approach would require the Postal Service to choose the model producing variabilities that are higher (and closer to “1”) than variabilities derived from other models. When comparing multiple alternative sets of statistically reliable regression equations in Proposal Four, the Postal Service generally prefers a model specification and data aggregation that lead to an increase in

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<sup>40</sup> Petition, Proposal Four at 2; Bradley Report at 6-18. In Docket No. N2010-1, the Commission estimated “trip variabilities with respect to [transported cubic feet] of volume,” where the number of truck trips was used as a proxy of cubic foot miles of capacity. See PRC-N2010-1-LR-5, files “PRC Transportation Appendix.docx,” at 1 n.1 and “Summary PRC N2010-1-LR5.docx,” at 1.

the estimated variabilities. See Bradley Report at 19, 30, 32-33; Response to CHIR No. 1, question 4. The Commission finds this approach reasonable.

Likewise, the Commission supports the exclusion of TRACS tests with zero mail volumes prior to aggregating individual tests to daily totals for the econometric model. See Bradley Report at 19. As illustrated by both the Postal Service and the Public Representative, when the econometric model uses observations developed with all TRACS tests (including those with zero mail volumes), the estimated variabilities are significantly lower than when TRACS tests with zero mail volumes are not considered.<sup>41</sup> As correctly pointed out by commenters, recording individual TRACS with zero mail volumes might occur due to multiple reasonable circumstances, including the requirements of the USO or everyday operations. PR Comments at 11; Bradley Reply Report at 34.

For example, as illustrated by the FY 2015 TRACS data, for a notable share of individual TRACS tests with zero mail volumes, the tested vehicle transported empty equipment. The share is in the range of 21 and 32 percent for different transportation contract types.<sup>42</sup> Moreover, for any individual TRACS test with zero mail volume, it is always a non-zero vehicle capacity which is not associated with any transported mail volume in a sampling group.<sup>43</sup> Consequently, these TRACS tests do not provide any information about the actual relationship between vehicle capacity and mail volume for the purchased highway transportation.

Similar conclusions would not, however, be valid for TRACS tests that include non-zero mail volumes, even when these volumes are relatively small. As illustrated by TRACS data and confirmed by multiple commenters, the Postal Service's purchased

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<sup>41</sup> See Bradley Report at 18-19; PR Comments at 14; PR-RM2016-12/1, file "Intermediate Specification Analysis.docx," at 1.

<sup>42</sup> See USPS-RM2016-12/1, folder "Input.Data.Sets," file "fy15weight. sas7bdat." For a description of the abbreviated column headings in the referenced SAS data file, see Response to CHIR No. 1, question 9.

<sup>43</sup> For testing purposes, all mail unloaded from the vehicle is separated into five sampling groups. See Handbook F-65 at 10-11.

highway transportation network operates with excess capacity. PR Comments at 11, 24; Brattle Reply Report at 3-4; UPS Comments at 3-4. As the Commission estimated in Docket No. N2010-1 using TRACS data, the percentage of empty vehicle space (when space taken by empty equipment is excluded) remains relatively constant across years and days of the week.<sup>44</sup> The TRACS dataset with a cut-off level for capacity utilization, either of 50 percent as suggested by UPS or of any other percentage level, will not reflect the actual relationship between capacity and volume, and make the results of econometric analysis unreliable.<sup>45</sup>

## B. Suggested Additional Variables

Commenters suggest additional variables that might be included in the econometric model to allow for a better accounting for economic realities. Their comments address the addition of regional dummy variables, dummy variables for fiscal year and postal quarter, an alternative specification for DOW, and mail shape variables.

For the reasons discussed below, the Commission does not support the inclusion of additional variables into the econometric model.

### 1. Commenters' Arguments

*Regional dummy variables.* UPS argues that aggregation of data across the entire Postal Service highway transportation network obscures important geographic differences in mail volume trends, which, if considered, would significantly affect capacity-to-volume variabilities. Brattle Report at 34; see *also* UPS Comments at 16. After grouping the data within 21 geographic regions, UPS performs a regression analysis to analyze volume trends over time in each region.<sup>46</sup> UPS concludes that there

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<sup>44</sup> See Docket No. N2010-1, Advisory Opinion at 125; Library Reference PRC-N2010-1-LR-4, March 24, 2011.

<sup>45</sup> As illustrated by the UPS analysis, the higher the cut-off level, the higher the estimated variabilities. See Brattle Report at 39.

<sup>46</sup> UPS performs this analysis specifically for Intra-NDC routes. See Brattle Report at 34-35.

is a “substantial geographic heterogeneity in mail volume trends,” which “is not accounted for in Proposal Four.”<sup>47</sup>

The Public Representative notes that although he cannot verify the accuracy of UPS’s geographic analysis, he suggests that “a regional variable should at least be tested in the future.” PR Reply Comments at 7.

*Dummy variables for fiscal year and postal quarter.* The Public Representative asserts that to “control for effects unique to a postal quarter or fiscal year,” the model should include a set of dummy variables for each postal quarter and fiscal year. PR Comments at 13. Using the first quarter as an example, the Public Representative notes that due to the holiday season, trucks are more likely to use additional capacity. He states that “[n]ot controlling for this effect could result in omitted variable bias.”<sup>48</sup>

UPS and AFSI do not agree that the addition of dummy variables for each year and quarter would benefit the econometric model. Brattle Reply Report at 8; Thompson Declaration at 23. UPS argues that the additional variables “are likely to be correlated with volume trends,” and could “pick up” certain “volume effects” that the econometric model is “intended to measure.” Brattle Reply Report at 8. AFSI states that adding such dummy variables would obscure currently observed significant variations in mail volumes between quarters and years.<sup>49</sup>

The Postal Service also does not support the inclusion of these additional dummy variables and states that the Public Representative did not explain what “forces

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<sup>47</sup> Brattle Report at 35; see USPS-RM2016-12/1, folder “3 - Regional Volume Analysis,” workbook “Annual Regional Volume Trend.”

<sup>48</sup> *Id.* The Public Representative provides a modified Proposal Four econometric model where he includes dummy variables for the year and quarter as well as the set of dummy variables for each day of the week (which replaces the DOW variable in Bradley’s analysis). PR Comments at 9-10, 13-14; see also PR-RM2016-12/1, file “Intermediate Specification Analysis.docx.” Also, the Public Representative’s modified model considers zero-volume observations that were excluded from Bradley’s econometric analysis. *Id.* The Public Representative notes that the variabilities estimated from his modified model appear to be lower than the variabilities in Proposal Four. PR Comments at 14-15; see also PR-RM2016-12/1, file “Intermediate Specification Analysis.docx.”

<sup>49</sup> Thompson Declaration at 23. AFSI acknowledges the appropriateness of these dummy variables to control for omitted variables, but he does not believe that there are significant omitted variables. *Id.* at 23-24.

other than volume movements” would “cause capacity to vary through time.” Bradley Reply Report at 34-35.

*Alternative specification for day-of-week.* The Public Representative disagrees with the model specification where DOW is a discrete variable with values from “1” to “7” (where “1” is set for Sunday). PR Comments at 12. He argues that such an approach “is only reasonable if mail capacity increases or decreases consistently from Sunday to Saturday.” *Id.* at 12-13. The Public Representative contends that instead, the DOW variable should be set as a series of dummy variables, one for each day of the week. *Id.* at 13. The Public Representative also notes that while the Postal Service claims that the reason for choosing a discrete DOW variable was to decrease the risk of a singular matrix, its own analysis demonstrates that dummy variables do not cause a singular matrix to occur.<sup>50</sup>

*Mail shape variables.* The Public Representative argues that mail shape is “an important driver in transportation” and “should be incorporated into the variability model.” PR Comments at 28; see also PR Reply Comments at 7-8. In his reply comments, the Public Representative examines the change in cubic mail volume in FY 2011 through FY 2015, and concludes that there are “substantial differences in the rate of mail volume change, by contract type and mail shape.”<sup>51</sup>

## 2. Commission Analysis

The Commission does not find sufficient support for inclusion of the suggested additional variables into the econometric model. The inclusion of additional dummy variables would be appropriate only if “there is good reason to believe” that there are statistically “significant omitted variables” in the provided econometric analysis. See

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<sup>50</sup> *Id.* at 12-13. The Public Representative refers to the Response to CHIR No. 1, question 2. For the Public Representative alternative regression analysis and results, see PR-RM2016-12/1, file “Intermediate Specification Analysis.docx,” at 2; PR-RM2016-12/1, file “RM2016-12-PR-LR-1 SAS Output.mht.”

<sup>51</sup> PR Reply Comments at 7-8; see also PR-RM2016-12/1.

Thompson Declaration at 23-24 n.15. The Commission has previously addressed the issue of a potential omitted-variable bias and included additional dummy variables into regression models to test whether omitted variables caused biased estimates.<sup>52</sup>

Considering that the econometric model underlying Proposal Four already includes volume as an explanatory variable, as pointed out by commenters, it does not seem reasonable to include additional dummy variables to account for potential fluctuations in volumes by quarter and year.<sup>53</sup> Similarly, the Commission does not consider that any existence of volume fluctuation by region results in omitted variable bias and requires inclusion of additional variables or trends in an econometric model.

The Postal Service's econometric model already includes two sets of dummy variables (one for contract size and one for a possible break in network size). Bradley Report at 12, 16; Response to CHIR No. 1, question 2. As the Commission previously stated, the presence of dummy variables in the model "might degrade its robustness."<sup>54</sup> As proved by results of a modified econometric model presented by the Public Representative, inclusion of additional dummy variables lowered R<sup>2</sup> statistics and led to a decrease in variabilities estimated from all four regression equations.<sup>55</sup>

Also, the inclusion of dummy variables into a model, due to their possible correlation with already existing regression variables or volume trends, might either

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<sup>52</sup> See Docket No. RM2015-7, Order Approving Analytical Principles Used in Periodic Reporting (Proposal Thirteen), October 29, 2015, Appendix B at 1-2 (Order No. 2792).

<sup>53</sup> Inclusion of a dummy variable for FY 2010, as suggested by the Postal Service, provides a reasonable exception. This variable accounts for significant structural changes occurred between this year and subsequent years. See Brattle Report at 16-17. The final Postal Service regression equation used to estimate capacity-to-volume variabilities still does not include the FY 2010 data. See *id.* at 29-30; USPS-RM2016-12/1, folder "Est.Cap.Vol.Mod.FY11.15.Drop.Zero.Test.Auto."

<sup>54</sup> Docket No. R2013-11, Order No. 1926, Order Granting Exigent Price Increase, December 24, 2013, at 64 n.57.

<sup>55</sup> See PR-RM2016-12/1, file "Intermediate Specification Analysis.docx," at 2. The Commission generally agrees with the Public Representative that for categorical factors, including DOW, it is a common practice to apply dummy variables. See, e.g., Susan Garavaglia & Asha Sharma, *A Smart Guide to Dummy Variables: Four Applications and a Macro*, February 2016 (available at: <http://stats.idre.ucla.edu/wp-content/uploads/2016/02/p046.pdf>). The Commission suggests that in any future studies where econometric analysis considers categorical factors (e.g., a postal quarter, day of the week) the Postal Service test dummy variables for their inclusion into a model.

result in “biasing effects” (as noted by AFSI) or “confound a...regression’s ability” to properly estimate capacity-to-volume variabilities (as noted by UPS). Brattle Group at 8; Thompson Declaration at 23 n.15.

The Commission concludes that the variabilities estimated using the proposed econometric model are statistically reliable and can be applied to highway transportation accounts associated with regular routes.

## VII. CREDITABILITY OF THE OVERALL COST-TO-VOLUME VARIABILITIES

Commenters question whether the product of two variabilities (cost-to-capacity variability estimated using Transportation Contract Support System (TCSS) data and capacity-to-volume variability estimated using TRACS data) produce creditable results. Their comments address concerns regarding the differences between a moving capacity measure and CFM of capacity, the compatibility of TRACS and TCSS data, a certain endogeneity issue in the econometric analysis, and whether long-run variabilities are identified.

The Commission concludes that the product of the two variabilities developed using TCSS and TRACS data produce credible results. However, the Commission suggests that the Postal Service update its analysis the earlier of every 10 to 15 years or following the completion of any major structural reorganization.

### A. Commenters’ Arguments

*Moving capacity measure versus cubic foot miles of capacity.* UPS argues that the Postal Service’s measure of “moving capacity” used in the econometric model to estimate capacity-to-volume variabilities is different from the cubic foot miles of capacity measure used to estimate cost-to-capacity variabilities. Brattle Report at 32-33. UPS states that moving capacity is a “product of truck capacity and number of trip legs,” while cubic foot miles of capacity is a “product of truck capacity...number of trips and miles per trip.” *Id.* UPS stresses that the time period covered in the Postal Service’s analysis corresponded to the period of reorganization and restructuring of the Postal

Service's network of mail processing plants and cubic foot miles, and "moving capacity" may be incongruous measures as a result. *Id.*

*TRACS and TCSS compatibility.* The Public Representative contends that TCSS capacity measurements (used to estimate cost-to-capacity variabilities) are based on the specifications of transportation contracts, while TRACS capacity measurements are computed by a data collector who measures the volume of the truck. PR Comments at 20. The Public Representative asserts that this mismatch will reduce the reliability of the estimate of the overall cost-to-volume variability. *Id.* at 21.

The Postal Service argues that the Public Representative's concern does not have merit because there is a "known cubic capacity" of trucks in both data sets. Bradley Reply Report at 37.

The Public Representative also notes that the number of observations used in the calculation of variabilities differs in TRACS and TCSS. PR Comments at 19. The Public Representative further notes that to calculate capacity-to-volume variabilities, the Postal Service aggregated TRACS data by contract type. At the same time in Docket No. RM2016-4, it aggregated TCSS data by route type within each contract type to calculate cost-to-capacity variabilities. *Id.* at 18. The Public Representative maintains that the difference in the "data structures and number of observations" between the two studies would likely bias "the product of the two types of variabilities." *Id.* at 19.

The Postal Service argues that the Public Representative fails to explain the direction of the bias, the source of the bias, a mathematical justification for the bias, or the magnitude of the bias. Bradley Reply Report at 35. The Postal Service points out that the Public Representative's concern over different levels of aggregation in TRACS and TCSS datasets used for estimating variabilities is unfounded because "both sets of variabilities are estimated for the Postal Service's account categories." *Id.* at 36. The Postal Service explains that although "individual variability equations are estimated by truck type," they are combined at the account category level before being applied. *Id.* The Postal Service also notes that the Commission already combined distribution keys



based on TRACS data (distribution keys) with cost-to-capacity variabilities based on TCSS. *Id.* at 35-36.

*Endogeneity issue in econometric analysis.* The Public Representative also expresses a concern about an “endogeneity issue” that, he believes, biases the overall cost-to-volume variability (which is a product of two variabilities). PR Comments at 22-23. The Public Representative argues that capacity measures used in the calculation of both variabilities interact with each other, which results in biased cost-to-capacity variability estimates. *Id.* at 23. The Public Representative maintains that such bias cannot be corrected when multiplying cost-to-capacity and capacity-to-volume variability estimates. *Id.*

The Postal Service notes that, first, variabilities that “relate solely to the cost-to-capacity model” are irrelevant to the potential adoption of Proposal Four, and second, in a two-step model, “[a] variable can be endogenous in one model and exogenous in another one.” Bradley Reply Report at 37-38.

*Long-run and short-run variabilities.* The Public Representative states he is not convinced that the proposed model is appropriate for estimating “long-term variabilities, which is the Commission’s goal for variability studies.” PR Comments at 4, 27. The Public Representative further suggests that the Commission open an inquiry regarding relevant “data, operational factors, and types of models,” which would “produce unbiased long term variability estimates.” *Id.* at 4, 26.

UPS agrees that the Commission should rely on long-run cost-to-volume variabilities. UPS Reply Comments at 2-3; Brattle Reply Report at 1-4. UPS argues that the Postal Service’s model captures at most the short-run variabilities and “should not be used for costing purposes.” Brattle Reply Report at 1-2. UPS emphasizes that a long-run prospective in variability analysis is especially important during time periods when volume declines, and it should assist the Postal Service during the restructuring of its network. *Id.* at 2.

## B. Commission Analysis

Pursuant to the current methodology, the variability of purchased highway transportation cost is a product of two variabilities: variability of cost with respect to capacity (cost-to-capacity variability) and variability of capacity with respect to volume (capacity-to-volume variability). Both cost-to-capacity variabilities and capacity-to-volume variabilities include capacity as a major determinant. So it is important to ensure that in the econometric analyses used to produce these two types of variabilities the capacity measures are identical; meaning that they provide the same response (in terms of percent change) to a 1-percent change in mail volume.

In Docket No. RM2014-6 (where the Commission approved the currently applied cost-to-capacity variabilities), the Postal Service defined vehicle capacity as CFM of transportation used.<sup>56</sup> For each route, the cubic foot miles of vehicle capacity were estimated as a product of vehicle capacity measured in cubic feet (cube) and annual route distance measured in miles (miles).<sup>57</sup> Annual route miles are determined by multiplying the average trip distance on the route and the average number of trips on the route.<sup>58</sup> See Bradley Report at 21; Response to CHIR No. 2, question 4.

In its econometric analysis in the current docket, the Postal Service applies a measure of capacity which it identifies as “moving capacity” and calculates as the cubic capacity of the vehicle (cube) multiplied by the number of trips per year (trips). Bradley Report at 21; Response to CHIR No. 2, questions 2 and 3; Response to CHIR No. 1,

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<sup>56</sup> See Docket No. RM2014-6, Petition of the United States Postal Service for the Initiation of a Proceeding to Consider Proposed Changes in Analytical Principles (Proposals Three through Eight), June 20, 2014, Proposal Six at 2 (Docket No. RM2014-6, Petition); Docket No. RM2014-6, Library Reference USPS-RM2014-6/1, June 20, 2014, at 2. For purchased highway transportation, in 2 out of 17 econometric equations used to estimate cost-to-capacity variabilities by transportation highway account category and type of transportation the Postal Service replaced cubic foot miles with the number of boxes. See Docket No. RM2014-6, Petition, Proposal Six at 2; USPS-RM2014-6/1 at 12.

<sup>57</sup> See Docket No. RM2014-6, Petition, Proposal Six at 2; USPS-RM2014-6/1, part 2 at 8.

<sup>58</sup> Since there is often more than one trip on each route, the number of annual route miles is calculated as a sum of all annual trip miles on this route. Annual trip miles for each trip are calculated by multiplying a trip distance (measured in miles) and its annual operating frequency. See USPS-RM2014-6/1, part 2 at 68.

question 9. Considering that the number of trips per year serves as a measure of the annual frequency, the trips variable is consistent with the frequency variable used in the formula for CFM capacity measure in Docket No. RM2014-6. Response to CHIR No. 2, question 4. However, while the CFM capacity measure is proportional to “the route miles that the vehicle traverses,” the moving capacity measure is not. Bradley Report at 20-21.

The Commission concludes that it is reasonable to replace the CFM measure with the moving capacity measure because observations for econometric analysis are developed from the TRACS database, which includes data collected at a stop (testing facility), and the travel distance for a tested vehicle is already determined by the length of the relevant transportation leg. See Bradley Report at 20; Response to CHIR No. 2, question 4. As correctly pointed out by the Postal Service, vehicle travel distance (miles) “play[s] little or no role in the determination of elasticity of capacity with respect to volume.” Bradley Report at 20. Consequently, a replacement of moving capacity measure with the CFM measure in the econometric equation used to estimate capacity-to-volume variabilities in Proposal Four would not change the variability estimates.<sup>59</sup>

Also, considering that all variability estimates are aggregated to the transportation account level before being multiplied together to calculate the overall cost-to-volume variability, the Commission concludes that variabilities estimated using TCSS and TRACS data are compatible.

In addition, the Commission finds that the endogeneity concern expressed by the Public Representative is not supported by any empirical analysis. The fact that a variable (capacity) is a determinant of two econometric models (developed to estimate

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<sup>59</sup> Replacing moving capacity (Capacity) with cubic foot miles (CFM) in the left part of a translog regression equation provided on page 21 of the Bradley Report results in:  $\ln(\text{CFM}) = \ln(\text{Cube} * \text{Trips} * \text{Miles})$ , where “ln” is the natural logarithmic (log) function. Taking into account that  $\text{Capacity} = \text{Cube} * \text{Trips}$ , and using properties of natural log,  $\ln(\text{CFM})$  transforms into:  $\ln(\text{Capacity} * \text{Miles}) = \ln(\text{Capacity}) + \ln(\text{Miles})$ . After differentiating both parts of a translog regression equation, the variability is estimated. Considering that elasticity of miles with respect to volume is zero (the number of miles that a vehicle traverses on any particular transportation leg does not change in response to a change in the transported mail volume), variability of CFM with respect to volume is the same as variability of moving capacity with respect to volume.

either cost-to-capacity or capacity-to-volume variabilities) does not provide any supporting evidence that an endogeneity problem actually exists. On the contrary, as pointed out and illustrated by the Postal Service, having a variable endogenous in one model and exogenous in another model is a common practice. See Bradley Reply Report at 37-38.

UPS expresses a concern that although “mileage is tied to plant locations” due to the reorganization of the transportation network from 2012 through 2013, “results from an analysis of the relationship between cubic feet of moving capacity and cubic feet of mail are likely at best a poor proxy for the results.” Brattle Report at 33. Considering that the econometric analysis in the current docket uses the TRACS data for the period from FY 2011 through FY 2015, the referenced network changes are captured by the TRACS dataset. A similar conclusion is valid for the econometric analysis in Docket No. RM2014-6, which relied upon the TCSS data for Quarter 4 of FY 2013. At the same time, the Commission agrees that structural network changes might modify the relationship between purchased highway transportation capacity and transported mail volume. Because of this, and in response to the commenters’ arguments regarding long-run variabilities, the Commission suggests that the Postal Service update its variability estimates the earlier of every 10 to 15 years or following the completion of any major structural reorganization.

The Commission concludes that the product of the two variabilities developed using TCSS and TRACS data produce reliable results.

#### VIII. UPDATED VARIABILITIES AND COST IMPACT

The Postal Service’s final capacity-to-volume variabilities are estimated by four aggregated highway transportation account categories using a translog regression model, with the aggregation of individual TRACS tests by day of the week in each quarter of FY 2011 to FY 2015.<sup>60</sup> For highway transportation accounts associated with

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<sup>60</sup> The estimated variabilities are corrected for autocorrelation.

regular routes only, the Commission approves the capacity-to-volume variabilities as they are estimated by the Postal Service. For transportation accounts associated with emergency and Christmas routes, Proposal Four does not provide sufficient empirical support for updating capacity-to-volume variabilities. The Commission considers these variabilities to be equal to “1” until additional empirical research shows otherwise. The overall cost-to-volume variabilities, as a product of cost-to-capacity and capacity-to-volume variabilities, are updated for regular routes transportation accounts only. No changes in variabilities of purchased highway transportation are made applicable to emergency and Christmas routes transportation accounts. Table VIII-1 presents the variabilities as they are accepted by the Commission.<sup>61</sup>

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<sup>61</sup> The Plant Load account category has not been subject to Proposal Four, and therefore variabilities for this account have not been updated.

**Table VIII-1**  
**Variabilities of Purchased Highway Transportation**  
**by Transportation Account Category<sup>1</sup>**

Transportation Account/ Category	Cost-to-Capacity Variability (RM2014-6)	Capacity-to-Volume Variability (Proposal Four)		Overall Cost-to-Volume Variability	
		Regular Routes	Emergency and Christmas Routes	Regular Routes	Emergency and Christmas Routes
Intra-P&DC	0.757	0.773	1.000	0.585	0.757
Intra-District	0.380	0.773	1.000	0.294	0.380
Intra-SCF	0.643	0.773	1.000	0.497	0.643
Inter-P&DC	0.850	0.821	1.000	0.698	0.850
Inter-Cluster	0.891	0.821	1.000	0.732	0.891
Inter-Area	0.899	0.821	1.000	0.738	0.899
Inter-SCF	0.891	0.821	1.000	0.732	0.891
Intra-NDC	0.949	0.788	1.000	0.748	0.949
Inter-NDC	0.947	0.848	1.000	0.803	0.947
<sup>1</sup> Excludes accounts associated with exceptional routes. Variabilities for exceptional routes were not subject to updates since Docket No. R2000-1 and are considered "1." Source: PRC-LR-RM2016-12/1, Excel file "PRC-LR-RM2016-12/1.xlsx," tab "Inputs – Variabilities_Upd."					

The impact of the updated variabilities on FY 2016 purchased transportation costs attributable to products are presented in Table VIII-2. The estimated impact on attributable costs is smaller than presented in the Petition.<sup>62</sup> As discussed in section V.B, the updated variabilities shall be applied only to the highway transportation accounts associated with regular routes.

<sup>62</sup> Related calculations are presented in Library Reference PRC-LR-RM2016-12/1 and Library Reference PRC-LR-RM2016-12/NP1.

**Table VIII-2**  
**Impact of Capacity-to-Volume Variabilities**  
**on FY 2016 Transportation Costs (\$000)**

	<b>New Total Transportation Cost</b>	<b>Old Total Transportation Cost</b>	<b>Absolute Change</b>	<b>Percentage Change</b>
<b>First-Class:</b>				
Single-Piece Letters	\$272,712	\$315,150	-\$42,438	-13.5%
Single-Piece Cards	\$5,196	\$6,166	-\$970	-15.7%
Presort Letters	\$469,701	\$507,094	-\$37,392	-7.4%
Presort Cards	\$19,804	\$21,388	-\$1,584	-7.4%
Single-Piece Flats	\$160,634	\$181,015	-\$20,381	-11.3%
Presort Flats	\$57,077	\$62,872	-\$5,794	-9.2%
Parcels	\$59,791	\$69,314	-\$9,524	-13.7%
<b>Total First-Class</b>	<b>\$1,044,916</b>	<b>\$1,162,998</b>	<b>-\$118,083</b>	<b>-10.2%</b>
<b>Standard Mail:</b>				
High Density and Saturation Letters	\$6,554	\$8,016	-\$1,462	-18.2%
High Density and Saturation Flats & Parcels	\$15,364	\$18,974	-\$3,610	-19.0%
Carrier Route	\$63,369	\$76,306	-\$12,938	-17.0%
Letters	\$170,524	\$203,569	-\$33,045	-16.2%
Flats	\$149,394	\$177,856	-\$28,462	-16.0%
Parcels	\$5,265	\$6,373	-\$1,108	-17.4%
Every Door Direct Mail – Retail	\$0	\$0	\$0	0.0%
<b>Total Standard Mail</b>	<b>\$410,470</b>	<b>\$491,094</b>	<b>-\$80,624</b>	<b>-16.4%</b>
<b>Periodicals:</b>				
In County	\$102	\$127	-\$25	-19.7%
Outside County	\$198,033	\$234,839	-\$36,806	-15.7%
<b>Total Periodicals</b>	<b>\$198,135</b>	<b>\$234,966</b>	<b>-\$36,831</b>	<b>-15.7%</b>
<b>Package Services:</b>				
Alaska Bypass	\$16,720	\$19,714	-\$2,994	-15.2%
Bound Printed Matter Flats	\$13,075	\$15,671	-\$2,597	-16.6%
Bound Printed Matter Parcels	\$20,044	\$24,223	-\$4,178	-17.2%
Media and Library Mail	\$83,696	\$99,690	-\$15,994	-16.0%
<b>Total Package Services</b>	<b>\$133,534</b>	<b>\$159,298</b>	<b>-\$25,764</b>	<b>-16.2%</b>
<b>Free Mail</b>	<b>\$5,461</b>	<b>\$6,365</b>	<b>-\$904</b>	<b>-14.2%</b>
<b>Total Domestic Market Dominant</b>	<b>\$1,808,150</b>	<b>\$2,072,006</b>	<b>-\$263,857</b>	<b>-12.7%</b>
<b>Total Domestic Competitive</b>	<b>\$2,902,336</b>	<b>\$3,158,388</b>	<b>-\$256,052</b>	<b>-8.1%</b>
<b>International</b>	<b>\$818,152</b>	<b>\$835,253</b>	<b>-\$17,100</b>	<b>-2.0%</b>
Source: PRC-LR-RM2016-12/1, "PRC-LR-RM2016-12/1.xlsx," tab "Outputs to CRA."				

## IX. CONCLUSIONS AND RECOMMENDATIONS

The Commission approves the proposal to update capacity-to-volume variabilities for highway transportation accounts and the cost pools associated with regular routes only.

Further development is necessary with respect to emergency and Christmas transportation routes before approval can be granted. The Postal Service does not provide sufficient empirical support for updating variabilities for accounts associated with these routes. Considering that the TRACS database used as a data source for estimating capacity-to-volume variabilities includes regular contracts only in its sampling frame, emergency and Christmas contracts are excluded from the provided variability analysis. In regard to capacity-to-volume variabilities for these routes, the Commission suggests that the Postal Service perform further research (e.g., in the form of a special study) that would allow updating variabilities for these routes, if feasible. It will be important to ascertain a clear understanding of whether emergency and Christmas routes have notably higher capacity utilization than regular routes and whether peak mail volumes should be specifically considered in the econometric analysis.

Finally, to ensure that variabilities of purchased highway transportation cost reflect the current Postal Service transportation network structure, the Commission suggests the Postal Service update its variabilities the earlier of every 10 to 15 years or following completion of any major structural reorganization.



X. ORDERING PARAGRAPHS

*It is ordered:*

1. The Commission approves the aspects of Proposal Four with respect to the calculation of variabilities applicable to transportation accounts associated with regular routes only.
2. The Commission does not approve the aspects of Proposal Four with respect to emergency and Christmas transportation routes.
3. The Commission directs the Postal Service to, at a minimum, update the variabilities of purchased highway transportation the earlier of every 10 to 15 years or following completion of any major structural reorganization.

By the Commission.

Ruth Ann Abrams  
Acting Secretary

## APPENDIX

### THE BRATTLE GROUP SIMULATION MODEL: SUMMARY AND ANALYSIS

#### I. SIMULATION MODEL: PURPOSE, DESIGN, AND RESULTS

The Brattle Group developed a simulation model (Brattle Model) for UPS to test the reliability of Proposal Four methodology.<sup>1</sup> The specific purpose of the Brattle Model is to test whether TRACS low sampling rates, combined with the volume measurements taken at random stops (and not at the stops with peak mail volume) bias the calculated capacity-to-volume variabilities downward. Brattle Report at 36, 39, 47.

In its mail delivery model, the Brattle's Group simulates a transportation network and then generates "synthetic data" of mail volumes in this network.<sup>2</sup> A transportation network is divided into zones (geographic areas) with points (population centers) in each zone. *Id.* The point with the greatest population in each zone is labeled as a hub, while all other points are labelled as nodes.<sup>3</sup> The Brattle Model is built around 10 delivery regions, each containing 50 randomly designated population centers. *Id.* The Brattle Group asserts that it uses a gravity model approach to determine daily mail volume flows between any two points (origin-destination pairs) in the transportation network. *Id.*; Brattle Report at 40-41. Twenty-two highway routes (each having multiple legs) were developed in the transportation network to connect nodes and hubs in the network. Brattle Report at 41. The Brattle Group maintains that by construction of its model, the capacity of each route "adjusts at the start of each quarter to accommodate exactly the maximum volume that will be encountered on a route," and therefore the

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<sup>1</sup> See Brattle Report at 40-47; UPS Comments at 17-19; UPS-LR-RM2016-12/1, file "UPS-RM2016-12-1 Preface.pdf."

<sup>2</sup> Brattle Report at 40-41; UPS Comments at 17; UPS-LR-RM2016-12/1, file "2 - README - Creation of Synthetic Dataset.zip," file "README - Creation of Synthetic Dataset.docx."

<sup>3</sup> *Id.* The Brattle Group assumes that each transportation hub is analogous to an NDC, while all nodes are analogous to an SCF. *Id.*

“variability of capacity with respect to volume at the route level is equal exactly to one.” *Id.* at 42.

Considering that in this simulated transportation network the variability of capacity with respect to volume is known in advance “with certainty,” the Brattle Group applies the Proposal Four methodology to check whether it “produces the correct value for the variability.” *Id.* at 40.

The simulation model data set is sampled using different sampling rates: 10 percent, 2.5 percent, and 1 percent (for both intra-zonal and inter-zonal routes) and 0.1 percent (specifically for intra-zonal routes). *Id.* at 42. For the overall dataset and each constructed sample, the Brattle Group obtains sets of “Bradley-style capacity and volume estimates.” *Id.* To estimate capacity-to-volume variabilities, for each sampling rate, the Brattle Group draws 100 random samples of stop-days and then averages the variabilities calculated for each such sample. *Id.* The Brattle Group notes that “the variability estimate declines noticeably” with the lower sampling rates, and “the volume and capacity estimates become increasingly noisy.” *Id.* at 44.

The Brattle Group concludes that “low sampling rates in the TRACS data—ranging from 0.01 to 0.5 percent—have resulted in a similar downward bias of the resulting variability estimates recommended by Professor Bradley.” *Id.* at 47. UPS reiterates the Brattle Group’s conclusions from the simulation. UPS Comments at 18-19. UPS also adds that “the volume in TRACS sampled stops are actually representative of the volume along that route only by chance, while the route’s aggregate capacity will be much more accurately measured since it does not change across stops.” *Id.* at 19.

## II. COMMENTS CONCERNING THE BRATTLE MODEL

AFSI and the Postal Service criticize the Brattle Model for failing to realistically model the Postal Service’s network and operations. Bradley Report at 31-33;

Thompson Declaration at 11, 21. For example, the Postal Service notes that the model does not account for the Postal Service's flexibility to add additional trips on heavy mail volume days of the week or year. Bradley Report at 32. AFSI contends that the simulated routes are "obviously inefficient." Thompson Declaration at 11, 21. The Postal Service asserts that the simulated highway transportation network is abstract and unrealistic. Bradley Reply Report at 31-32. They both characterize the Brattle Model as artificial. The Postal Service points out that the simulated network assumes a much higher truck capacity utilization rate than the Postal Service's purchased highway network actually has. *Id.* at 29-31; Postal Service Reply Comments at 4. The Postal Service explains that the Brattle Model does not consider service requirements that lead to low capacity utilization on local transportation, which in turn, generates "available capacity for handling additional volume without adding additional capacity." Bradley Reply Report at 32. AFSI also criticizes the Brattle Model for implying economically irrational logistics behavior and for not considering the Postal Service's ability to control peak load volumes. Thompson Declaration at 12-17.

AFSI notes that the limited number of routes and oversimplified presentation of capacity in the model (having capacity for a route set at the beginning of a quarter and keeping it unchanged for the duration of the quarter) does not allow for any significant variation in the capacity variable. *Id.* at 30. AFSI argues that lack of such variation could explain why the simulations demonstrate a decreasing estimate of variability as sampling rate decreases, or in other words, "a very large amount of negative bias when the sampling ratio is low." *Id.*

In addition, AFSI suggests a few adjustments to the Brattle Model. *Id.* at 20-27. AFSI maintains that while these are minor changes, they "dramatically change the simulation results."<sup>4</sup> After implementing the suggested changes to the original Brattle

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<sup>4</sup> *Id.* at 21. The adjustments are: (1) removal of seasonal dummy variables; (2) aggregating data as it was done in Proposal Four; and (3) allowing point-to-point routing of mail traveling between regions. *Id.* at 21-27.

Model, AFSI concludes that the “simulated bias shown in the [Brattle Group] analysis is dramatically reduced by these adjustments, even with low sampling rates.” *Id.* at 21.

The Postal Service takes issue with the Brattle Group’s simulation results being extended to the econometric analysis in Proposal Four. It argues that the simulation’s apparent demonstration that smaller sample sizes lead to downwardly biased variabilities does not apply to Proposal Four’s variabilities. Bradley Reply Report at 33. The Postal Service explains that opposite to the Brattle Model’s results generated by the synthetic data, the Proposal Four equations “do not produce the extremely low variabilities...and they exhibit both high t-statistics and high  $R^2$  statistics.” *Id.*

### III. COMMISSION ANALYSIS

The purpose of the Brattle Group simulation exercise is to test whether the application of Proposal Four methodology produces “the correct value for the variability.” Brattle Report at 40. The Brattle Group, however, does not apply the Proposal Four methodology to the actual Postal Service’s network. Instead, the Brattle Group simulates “the synthetic data” of volume and capacity as well as a “simple [highway transportation] network” where the mail is transported between origin-destination population center pairs. *Id.* at 40-41. The Brattle Group maintains that building a dataset from scratch is “[t]he only way...to find such a dataset.” *Id.* at 40.

The Commission agrees with AFSI and the Postal Service that the constructed network is oversimplified, abstract, and unrealistic, and the simulated data do not reveal a true interaction between volume and capacity. See Bradley Reply Report at 31-32; Thompson at 11-12, 30. For the reasons described below, the Commission does not accept the Brattle Model as a reliable tool for testing Proposal Four methodology.

Although the Brattle Group claims that the distribution of mail in the simulated network is determined by a gravity model, its design reflects only *the very basic* assumption of a gravity model requiring that “the attraction between two objects is

proportional to their mass and inversely proportional to their respective distance.”<sup>5</sup> In the formula the Brattle Group relies on for estimating the “gravitational interaction between two [spatial] points,” population in both points is taken as a proxy for their “mass.”<sup>6</sup> However, as the Commission previously stated, gravity transportation models almost always consider not only population (people who reside in the area), but also employment (people who work in the area).<sup>7</sup> Such a consideration is important since in large urban areas with a high concentration of business and government agencies, employment significantly exceeds population.<sup>8</sup> Also, the classical equation for the gravitational interaction between origin and destination points includes additional calibration parameters that are omitted from the Brattle Group gravity model, most likely for the sake of simplification.<sup>9</sup>

The simulated network is not just simple, as admitted by the Brattle Group, but abstract and artificial, as noted by AFSI and the Postal Service. Brattle Report at 41; Bradley Reply Report at 31-32; Thompson Declaration at 21. The Brattle Group concedes that “some features of the synthetic network...abstract from some of the operational complexities inherent in the Postal Service’s highway transportation network,” and the presented model “is not similar enough to the actual Postal Service transportation network to quantify the extent of the downward bias and thus to calculate true variabilities.” Brattle Report at 46-47. This statement contradicts another Brattle

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<sup>5</sup> See <https://people.hofstra.edu/geotrans/eng/methods/ch5m1en.html>.

<sup>6</sup> This is the formula that the Brattle Group uses to determine mail volumes between origin and destination points. The formula is provided in UPS-LR-RM2016-12/1, file “2 - README - Creation of Synthetic Dataset.zip,” file “README - Creation of Synthetic Dataset.docx,” at 1.

<sup>7</sup> Docket No. N2011-1, Advisory Opinion on Retail Access Optimization Initiative, December 23, 2011, at 70 n.65.

<sup>8</sup> The evident example is the District of Columbia where, according to the data from the United States Department of Commerce, Bureau of Economic Analysis, the employment by place of work exceeds population by at least 30 percent. See <https://www.bea.gov/regional/downloadzip.cfm>.

<sup>9</sup> For additional information about gravity models (including the standard formula) and their application in transportation, see, e.g., Robert Lane, Timothy J. Powell, & Paul Prestwood Smith, *Analytical Transport Planning*, at 86-87 (1971).

Group assertion that the structure of the simulated network “mirrors that of the Postal Service.” *Id.* at 40. The Commission agrees with the Postal Service that for “a different purchased highway transportation network” than the Postal Service currently has, “the estimated variabilities would be different.” Bradley Reply Report at 29; Postal Service Reply Comments at 4. Also, the Brattle Group developed hubs and nodes in the network based on population values only, which as discussed above provides a simplification and significantly decreases reliability of the simulation exercise.

Furthermore, the Brattle Model relies on a number of unsupported assumptions and, as a result, does not adequately represent the Postal Service’s operations and delivery process. Thus, when describing the model setup, the Brattle Report stated that the simulated trucks arrive at hubs “*completely full*,” and “the capacity of each highway transportation route adjusts at the start of each quarter to accommodate exactly the *maximum volume* that will be encountered on a route.” Brattle Report at 41-42. The Commission agrees with the Postal Service that service requirements impose additional restrictions on capacity utilization (especially on local transportation), which are not considered by the Brattle Model. Bradley Reply Report at 32; Postal Service Reply Comments at 4. The Postal Service’s purchased highway network not only has a different (lower) capacity utilization rate than the Brattle Group’s simulated network, but also exhibits much more operational flexibility than the Brattle Model assumes. Brattle Reply Report at 32; Postal Service’s Reply Comments at 4; Thompson Declaration at 13-15; AFSI Reply Comments at 3.

Finally, the Brattle Group asserts that its volume and capacity estimates generated using samples from “synthetic dataset” become “increasingly noisy” as the sample rate decreases. Brattle Report at 44-45. As noted by the Brattle Group, an “additional noise from sampling variability” is present even when estimates are taken from a 10-percent sample. *Id.* at 45. However, a resulting “weaker relationship between capacity and volume” generated from smaller samples, contrary to the Brattle Group’s assertions, does not provide any proof of unreliability of the Proposal Four

methodology. See *id.* Having statistically unreliable estimates for the simulated network and synthetic dataset that are different from the network and dataset used in Proposal Four, does not provide any proof that the methodology underlying Proposal Four is unreliable. Contrary to the results of the Brattle Group's simulation exercise and as pointed out by the Postal Service, variability estimates in Proposal Four are not very low and are derived from statistically reliable econometric equations. See Bradley Reply Report at 32-33.

The Commission therefore does not accept the Brattle Model as a testing tool for the reliability of Proposal Four.